

DART AEROSPACE

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MANUFACTURING PROCESS PROCEDURE

FOR PAINT COATINGS

Document No: MPP-172

REV. E

APPROVED BY:

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DIRECTOR OF OPERATIONS

Date: 8/12/15

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Date: 8/12/15

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Date: 8.10.15

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SUBJECT:
WORK INSTRUCTION
PAINT COATINGS

DOCUMENT NO:
MPP-172
Rev. E
08/07/15

LOG OF REVISIONS

Revision	Date	Pages	Description	Approval
N/C	04/09/13	All	Initial Release	Committee
A	10/18/13	All	Revised Document Format	Committee
B	08/19/14	3-4	Added Section 3.2-3.3 Added Section 4.2-4.4	Committee
C	04/30/15	3 All	Revised Section 1.0 Revised Document Format	Committee
D	07/13/15	4	Added New Section 6.0 Passivation	Committee
E	08/07/15	4 22-25	Added New Section 7.0 Electropolishing Added to Appendix A	Committee
Supercell				



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1.0 SCOPE

- A. This document defines the approved paint process(es) to be used in the preparation, priming, and top coatings of all applicable manufactured parts or products.
- B. MPP-186 Workmanship Standards Section 2.0 defines the visual acceptance criteria for painted parts and assemblies, as well as a Tape Test Procedure.

NOTE: Paint service provider, if required by customer flow-down requirements, shall be certified to perform specified standards and/or processes. See attached specification sheets for all detailed information regarding application processes.

2.0 ANODIZATION

2.1 HARD ANODIZE IAW MIL-A-8625 TYPE 3 CLASS 2, COLOR BLACK

2.2 HARD ANODIZE IAW MIL-A-8625 TYPE 3 CLASS 2, COLOR RED

3.0 PRETREATMENT

3.1 PRETREAT PR-148 ADHESION PROMOTER

- FOR USE ON ALUMINUM PRODUCTS IN CONJUNCTION WITH PRIMER NOTED IN SECTION 4.2

3.2 PRETREAT CARDINAL 4860-52 ACID ETCH WASH PRIMER (GREEN)

- FOR USE ON ALUMINUM, STEEL, AND STAINLESS STEEL PRODUCTS WITH PRIMER NOTED IN SECTION 4.3

3.3 PRETREAT CARDINAL 4860-4702 ACID ETCH WASH PRIMER (GRAY)

- FOR USE ON ALUMINUM AND STAINLESS STEEL PRODUCTS WITH PRIMER NOTED IN SECTION 4.3

4.0 PRIMER

4.1 DESOTO 515X349 IAW BMS 10-79 TYPE III CLASS A GRADE A

4.2 PRIMER IAW MIL-PRF-23377 TYPE I CLASS N

4.3 PRIMER CARDINAL 7760-4702 LOW VOC EPOXY PRIMER (LIGHT GRAY)

- FOR USE ON ALUMINUM, STEEL, AND STAINLESS STEEL PRODUCTS



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4.4 PRIMER CARDINAL 6760-4702 LOW VOC SANDING ACRYLIC POLYURETHANE (LIGHT GRAY) WITH CATALYST 340HP

- FOR USE ON PLASTICS, WOOD, AND COMPOSITE SUBSTRATES

5.0 TOP COAT

**5.1 BLACK: POLYURETHANE PAINT CARDINAL 6402-BK08 BLACK 20%
GLOSS WITH CATALYST 340HP**

**5.2 GUNMETAL GREY: POLYURETHANE PAINT CARDINAL 6428-GR02
WITH CATALYST 340HP**

**5.3 RED: POLYURETHANE PAINT CARDINAL 6409-RD03-S WITH
CATALYST 340HP**

**5.4 WHITE: POLYURETHANE PAINT CARDINAL 6402-WH08 WHITE 20%
GLOSS WITH CATALYST 340HP**

6.0 PASSIVATION

6.1 PASSIVATE IAW QQ-P-35C, TYPE II

7.0 ELECTROPOLISHING

7.1 ELECTROPOLISH IAW ASTM B912-02



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**APPENDIX A
PRETREATMENT, PRIMER AND PAINT SPECIFICATIONS**

Superseded

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TECHNICAL DATA

DeSoto® Conventional Exterior Primers

Description

DeSoto® conventional exterior primers are chemically cured, conventional solids, urethane compatible epoxy primers. These high performance primers are formulated to protect non-ferrous substrates from filiform and exfoliation corrosion. DeSoto® conventional exterior primers have excellent adhesion to a variety of substrates and exhibit a high degree of fluid and chemical resistance. These primers have been used successfully on a wide variety of aircraft throughout the world.

DeSoto® conventional exterior primers are compatible with all current spray equipment (except for 513X384 and 515X349, which cannot be electrostatic sprayed) and are easy to apply. DeSoto® conventional exterior primers can be removed with chemical paint strippers. For further details on the application parameters for these primers, consult the application guide for DeSoto® conventional exterior primers or contact your local PPG Aerospace Application Support Center.

DeSoto® conventional exterior primers are qualified to the following specifications:

513X384

- BMS 10-79 Type II Class A Grade A
- BPS 299-947-322
- HMS 16-1738
- MEP 10-060

513X377

- BAMS 565-008 Type II Class A Grade A
- BMS 10-79 Type II Class B Grade A
- I.C. TO-37.03
- MEP 10-060

515X349

- BMS 10-79 Type III Class A Grade A
- DHMS C4.18 Type III Class A Grade A
- DMS 2144 Composition A
- STMO 791

DeSoto® conventional exterior primers are compatible with the following topcoats:

- BAMS 565-009
- BMS 10-60 Type I & II
- BMS 10-72 Type VIII
- DMS 2143
- DPM 6456
- DPM 6546
- MEP 10-069

Application Properties (Typical)

Application temperature	65°F - 95°F (18.3°C to 35°C)
Application humidity	15% - 65%
Mix ratio (by volume)	
513X384 (Base)	1 part
910X456 (Activator)	1 part
513X377 (Base)	4 parts
910X482 (Activator)	1 part
020X364 (Thinner)	3 parts
515X349 (Base)	1 part
910X533 (Activator)	1 part
Viscosity	
Initial (#1 Zahn cup)	30 to 40 sec.
Potlife (8 hours)	30 to 40 sec.
VOC, EPA method 24 650 grams/l	
513X384	650 grams/l
513X377	685 grams/l
515X349	650 grams/l
Dry film density	
513X384 0.0086 lbs/ft² @ 1.0 mil dry film	
513X377 0.0086 lbs/ft² @ 1.0 mil dry film	
515X349 0.0095 lbs/ft² @ 1.0 mil dry film	
Theoretical coverage	
513X384 348 ft²/gal @ 1.0 mil dry film	
513X377 355 ft²/gal @ 1.0 mil dry film	
515X349 375 ft²/gal @ 1.0 mil dry film	
Recommended dry film thickness 0.5 to 0.9 mils (12.5 - 22.5 microns)	
Drying times @ 75°F (23.9°C)	
Tack free	30 min. max.
Dry to tape	2 hours
Dry to topcoat	2 to 72 hours
Dry to fly	48 hours
Full cure	7 days
Accelerated cure	
15 minutes flash off @ 75°F (23.9°C), then 30 minutes at 140°F (60°C)	
Color	
513X384/513X377	Yellow
515X349	Green
Spray equipment	
Compatible with all forms of spray equipment (except for BMS 10-79 Type II & III Class A)	
Shelf life	
12 months from date of manufacture	

Where Smart Solutions Take Flight®

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DeSoto® Conventional Exterior Primers

Performance Properties (Typical)

Service temperature -65°F to 350°F (54°C to 176.7°C)	Conforms
Flexibility 180° Conical Mandrel	Conforms
Low temperature flexibility 4 inch (100 mm) Mandrel @ -65°F (-54°C)	Conforms
Impact resistance 40 inch/lbs (46 cm/kg), Gardner	Conforms
Film hardness H pencil minimum	Conforms
Fluid resistance Skydrol® (LD-4), 30 days @ 75°F (23.9°C)	Conforms
Distilled H ₂ O, 7 days @ 75°F (23.9°C)	Conforms
Corrosion (with BMS 10-60 or DMS 2143 topcoats) Salt spray Passes 3000 hours	Conforms
Filiform Passes 30 days @ 100°F (37.8°C) and 85% RH	Conforms
Dissimilar metals 5% salt spray for 2000 hours	Conforms
Rain erosion Whirling arm	Conforms

Note: The application and performance property values above are typical for the material, but not intended for use in specifications or for acceptance inspection criteria because of variations in testing methods, conditions and configurations.

Storage Life

Inspect the condition of the container to ensure compliance to FED-STD-141, Method 3011.1. The material should be stored at temperatures between 40°F to 115°F (4.4°C to 46.1°C) to ensure shelf life.

Health Precautions

This product is safe to use and apply when recommended precautions are followed. Before using this product, read and understand the Material Safety Data Sheet (MSDS), which provides information on health, physical and environmental hazards, handling precautions and first aid recommendations. An MSDS is available on request. Avoid overexposure. Obtain medical care in case of extreme overexposure.

For industrial use only. Keep away from children.

Additional information can be found at:
www.ppgaerospace.com

For sales and ordering information call
1-800-AEROMIX (237-6649).

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product
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7760 PRIMER SERIES LOW VOC EPOXY PRIMER

Cardinal's 7760- series is a two-component epoxy primer. 7760- Series epoxy primer is well suited for metal surfaces that require weather, corrosion and chemical resistance applications are required.

TYPICAL USES:

- Steel enclosures
- Utility trailers
- Heavy duty equipment

BENEFITS:

- Low V.O.C.
- Free of heavy metals
- Excellent chemical and solvent resistance
- RoHS / WEEE compliant

CURED FILM PROPERTIES:

Testing conducted on 7760-4702 flat light gray, catalyzed with 77EH at 1.5 mils DFT (Dry Film Thickness) over 20 gauge Bonderite 1000® test panel cured 30 minutes at 180°F and air dried 14 days.

TEST	METHOD	PARAMETERS	RESULT
Adhesion	ASTM D3359	Cross-hatch tape	0% failure
Hardness	ASTM D3363	Pencil	F- H
Salt Spray	ASTM B117	1000 hrs 95%, 5% salt solution	Less than 3/16" creep - along scribe, otherwise, no effect
Solvent Resistance	ASTM D4752	MEK 50 rubs IPA 100 rubs	No effect No effect

Cure: Air Dry – ambient air temperature @ 78° F

catalyst	dust free	tack free	dry to handle	recoat	dry hard	full cure
77EH	5 min	5 - 10 min	1 - 2 hrs	2 hrs - 7 days	48 hrs	7 days

No Force Curing
Prior to Topcoat

FOR INDUSTRIAL USE ONLY
NOT FOR RESIDENTIAL USE

TYPE: Epoxy.

COMPONENTS: Two.

COLORS: Light Gray, Black, White and Red Oxide

GLOSS: Flat 0 - 5° @ 60 °

COVERAGE: At 1.0 mil DFT, 65% transfer efficiency(TE)

Mixed paint, 2.1 lbs/gal : 620 ft²/gal.

Calculation: 1604 #2/gal x % volume solids x TE + DFT

VOC MIXED: 250 grams/liter = 2.1 lbs/gal Excluding

110 grams/liter = 1.5 lbs/gal Including

See mix ratio table below.

VOLUME SOLIDS:

7760 Primer base 48%

77EH 66%

Mixed to 2.1 lbs/gal 49%

FLASH POINT:

7760-4702	7760-08, 7760-10, 7760-31	method
-4° F	-4° F	TCC

SHELF LIFE: 1 year from date of manufacture in factory sealed container.

APPLICATION: After preparing the surface, thoroughly mix component 1 before adding catalyst. Mix only the amount of material needed. The base to catalyst proportion must be measured accurately, by volume only, to obtain optimum film properties. Do not use reducers that contain water or alcohol; these react with the catalyst and can cause a variety of problems. Be aware of spray-able pot life. Brushing, rolling and dipping are not recommended.

MIX RATIOS: Two components must be mixed properly to obtain coating performance. Thinning depends on applicator's regulatory VOC limits.

Mix	parts by volume
7760 base	10 parts
77EH catalyst	1 part
SB-32	4 part
VOC =	2.1 lbs/gal

VISCOSITY: At 2.1 lbs/gal, the 7760 series primer will be in the 20"-25" #2 Zahn range.

SPRAY-able Pot Life: 2-3 hrs. at 2.1 lbs. VOC/gal

RECOMMENDED DFT: 1.0 – 2.0 mils

(Continued on page 2)

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7760 PRIMER SERIES

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SURFACE PREPARATION AND PRIMING: The most important steps in a successful coating process are cleaning, pretreatment and priming. The following is a brief outline of some basics for unpainted substrates. It is not intended to be all-inclusive. For more information on your particular application contact Cardinal.

Cleaning the substrate: All surfaces to be coated, must be free of dirt, grease, oil, oxidation, mill scale, and all other contaminants. The surface must be thoroughly dry before painting. Air quality regulations have limited the allowable emissions from cleaning operations.

Steel — A phosphate chemical conversion coating is highly recommended. When this is not possible, a vinyl acid wash pretreatment primer is recommended such as Cardinal's 4860 series primers.

Aluminum — A chemical conversion coating is highly recommended. When this is not possible, a vinyl acid wash pretreatment primer is recommended such as Cardinal's 4860 series primers.

Galvanized — Cardinal's W-303-A surface preparation solution helps improve adhesion followed by a vinyl acid wash pretreatment primer such as Cardinal's 4860 series primers.

Stainless Steel — Brush-off or blast clean per SSPC-SP 7 to a uniform profile of 1.5 mils. Cardinal's W-303-A surface preparation solution can help improve adhesion followed by a vinyl acid wash pretreatment primer such as Cardinal's 4860 series primers.

PRIMER SELECTION:

PRODUCT NO.	DESCRIPTION	FUNCTION
4860 Series	Acid etching pre-treatment primers	Corrosion resistance, some surfacing

RELATED PRODUCTS:

PRODUCT NO.	DESCRIPTION / FUNCTION
HP-439	Medium reducer.
J-3081	Surfactant. Helps eliminate blisters, bubbles, pin holes, solvent-pop.
6400- Series	High Solids Polyurethane
SB-32	Medium Reducer

TROUBLE SHOOTING:

PROBLEM	CAUSE	REMEDY
Blisters, pin holes or solvent pop	Water contamination. Entrapped air.	Eliminate water — Check air lines. Use fresh catalyst. Use urethane grade thinners.
Craters	Entrapped solvent.	Increase atomization, decrease film build.
	Contaminated ambient air, e.g., silicone mist, dust.	Locate and eliminate source of contamination.
Fish-eyes	Substrate contamination.	Clean and prepare substrate.
Not drying	Alcohol in reducer. Wrong catalyst ratio.	Use Cardinal's 1600 series or urethane grade reducers only. Double check mix ratio.
Poor adhesion	Improper surface preparation.	See surface preparation section.
Gloss variation	Variation in application, cure schedule, catalyst ratio, humidity.	Consistent gloss depends upon consistent process, e.g., air dried parts will not have same gloss as force dried parts.

APPLICATION EQUIPMENT: Most air quality regulations require the paint application transfer efficiency to be 65% or better. This generally means using electrostatic or high volume low pressure (HVLP) spray guns. Otherwise, conventional pressure feed, airless or air assisted airless spray equipment can be used. Air supply lines need water and oil traps.

EQUIPMENT CLEAN-UP: Clean up should be done as soon as possible keeping in mind the pot life of the mixed paint. Avoid leaving catalyzed paint in the lines. Air quality regulations have limited the allowable emissions from cleaning operations.

PRODUCT LIMITATIONS:

- 77EH is not recommended for outdoor exposure or UV radiation.
- Catalyst reacts with water. Air supply should be dry. Containers should be kept tightly closed. Use urethane grade thinners only.
- Alcohols and glycols interfere with curing chemistry and should be avoided. They can be found in some lacquer thinners and certain synthetic reducers.
- Optimum film properties are dependent upon proper mixing of paint and catalyst.

SAFETY: Refer to the product's Material Safety Data Sheet (MSDS) for complete safety information.

Contains organic solvents. Use with adequate ventilation. Do not breathe vapors or spray mists. If component TLVs are exceeded, a NIOSH approved air supplied respirator is advised. See MSDS for TLV information.

Contents are **FLAMMABLE**. Keep from heat, sparks or open flame.

Allergic reactions are possible. Avoid use by persons with respiratory problems.

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling.

FIRST AID:
Eye contact: flush immediately with plenty of water for at least 15 min. and get medical attention.

Skin contact: wash thoroughly with soap and water for 5 minutes.

If swallowed, do not induce vomiting and get medical attention immediately.

PRODUCT IDENTIFICATION

7 7 6 0 - 4 7 0 2 (example)
 ———— Color number
 ———— Gloss: 0 - 5*
 ———— Special: e.g., 2 = metallic; 6 = primer
 ———— Product type

G12TL

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CARDINAL

product
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6760 PRIMER SERIES

1 LB/GAL VOC SANDING ACRYLIC POLYURETHANE

Cardinal's 6760 series is a 1 LB/GAL VOC solvent two component polyurethane sanding primer designed to be applied direct to a variety of plastics, wood and composite substrates. The product is defined by fast dry, chemical resistance, hydrolysis resistance, adhesion and sand ability.

TYPICAL USES:

- Plastic substrates
- Composite substrates
- Medical equipment

BENEFITS:

- Low V.O.C.
- Free of heavy metals
- Excellent sandability and chemical resistance
- RoHS / WEEE Compliant

6760-SERIES 1LB/GAL VOC Plastic Primers has excellent adhesion to the following plastics:
ABS, Cycloy, Polycarbonate (Lexan), Noryl, Ultem, Valox, Xenoy and Kydex

CURED FILM PROPERTIES:

Testing conducted on 6760-4702 flat light gray, catalyzed with 340LASG at 1.5 mils DFT (Dry Film Thickness) over 20 gauge Bonderite 1000® test panel cured 30 minutes at 180°F and air dried 14 days.

TEST	METHOD	PARAMETERS	RESULT
Adhesion	ASTM D3359	Cross-hatch tape	0% failure
Hardness	ASTM D3363	Pencil	F- H
Solvent Resistance	ASTM D4752	MEK 25 rubs IPA 50 rubs	No effect No effect

Cure: Air Dry – ambient air temperature @ 78° F

catalyst	dust free	tack free	dry to handle	recoat	dry hard	full cure
340SG	5 min	20 min	4 hrs	4-6 hrs	48 hrs	7 days
340HP	10 min	30 min	4 hrs	4-6 hrs	48 hrs	7 days

Force Dry - the following will approximate a 72 hour cure @ 78° F

30 min @ 140° F	20 min @ 180° F
-----------------	-----------------

* Some Air quality regulations require a maximum temp. of 194° F to qualify as an "air dry" system which generally have higher VOC limits than baking systems.

SURFACE PREPARATION AND PRIMING: The most important steps in a successful coating process are cleaning, pretreatment and priming. The following is a brief outline of some basics for unpainted substrates. It is not intended to be all-inclusive. For more information on your particular application contact Cardinal.

Cleaning the substrate: All surfaces to be coated, must be free of dirt, grease, oil, oxidation, mill scale, and all other contaminants. The surface must be thoroughly dry before painting. Air quality regulations have limited the allowable emissions from cleaning operations.

Plastic — All mold release should be completely removed. 6760 series 2K Polyurethane is compatible with a variety of plastics, however, since there are numerous different formulations of plastic, a trial sample should be painted and checked for proper adhesion before running production

**FOR INDUSTRIAL USE ONLY
NOT FOR RESIDENTIAL USE**

TYPE: Acrylic polyurethane.

COMPONENTS: Two.

COLORS: Light Gray, Black, White and Red Oxide

GLOSS: Flat 0 - 5° @ 60°

COVERAGE: At 1.0 mil DFT, 65% transfer efficiency (TE)

Mixed paint, 1.0 lbs/gal : 600 ft²/gal.

Calculation: 1604 ft²/gal x % volume solids x TE = DFT

VOC MIXED: 120 grams/liter = 1.0 lbs/gal

51 grams/liter = 0.4 lbs/gal

See mix ratio table below.

VOLUME SOLIDS:

6700 S/G base 67%

340HP / 340SG 90%

Mixed to 1.0 lbs/gal 56%

FLASH POINT:

6460-E 12426, 6760-E15425,	method
6760-4702	
-4° F	TCC

SHELF LIFE: 1 year from date of manufacture in factory sealed container.

APPLICATION: After preparing the surface, thoroughly mix component 1 before adding catalyst. Mix only the amount of material needed. The base to catalyst proportion must be measured accurately, by volume only, to obtain optimum film properties. Do not use reducers that contain water or alcohol; these react with the catalyst and can cause a variety of problems. Be aware of spray-able pot life. Brushing, rolling and dipping are not recommended.

MIX RATIOS: Two components must be mixed properly to obtain coating performance. Thinning depends on applicator's regulatory VOC limits.

Mix	parts by volume
6760 base	9
catalyst	1 part 340HP / 340SG
solvent	3 parts HP-439
VOC =	1.0 lbs/gal

VISCOSITY: At 1.0 lbs/gal, the 6760 series primer will be in the 25"-30" #3 Zahn range

SPRAY-able Pot Life-3 hrs. at 1.0 lb. VOC/gal

RECOMMENDED DFT: 1.0 – 3.0 mils

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6760 PRIMER SERIES

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RELATED PRODUCTS:

PRODUCT NO.	DESCRIPTION / FUNCTION
6W00, 6S00, 6200 Series 2K Polyurethane	6W00 Series 1 LB/GAL 2K Waterborne Polyurethane 6S00 Series 1 LB/GAL 2K Solventborne Polyurethane 6200 Series 1 LB/GAL 2K Solventborne Polyurethane
Exempt Reducers	1000-13 Fast Exempt Reducer HP-430 Medium Exempt Reducer
Slow Reducer	SB-32 Slow Reducer
EL-005	Accelerator. Speeds up dry time (and shortens pot life).

TROUBLE SHOOTING:

PROBLEM	CAUSE	REMEDY
Blisters, pin holes or solvent pop	Water contamination. Entrapped air. Entrapped solvent	Eliminate water – Check air lines. Use fresh catalyst. Use urethane grade thinners. Increase atomization, decrease film build.
Craters	Contaminated ambient air, e.g., silicone mist, dust.	Locate and eliminate source of contamination.
Fish-eyes	Substrate contamination.	Clean and prepare substrate.
Not drying	Alcohol in reducer. Wrong catalyst ratio.	Use Cardinal's 1600 series or urethane grade reducers only. Double check mix ratio.
Poor adhesion	Improper surface preparation.	See surface preparation section.
Gloss variation	Variation in application, cure schedule, catalyst ratio, humidity.	Consistent gloss depends upon consistent process, e.g., air dried parts will not have same gloss as force dried parts.

APPLICATION EQUIPMENT: Most air quality regulations require the paint application transfer efficiency to be 65% or better. This generally means using electrostatic or high volume low pressure (HVLP) spray guns. Otherwise, conventional pressure feed, airless or air assisted airless spray equipment can be used. Air supply lines need water and oil traps.

EQUIPMENT CLEAN-UP: Clean up should be done as soon as possible keeping in mind the pot life of the mixed paint. Avoid leaving catalyzed paint in the lines. Air quality regulations have limited the allowable emissions from cleaning operations.

PRODUCT LIMITATIONS:

- 340SG is not recommended for outdoor exposure or UV radiation. Both will tend to yellow and also chalk sooner than 340HR.
- Catalyst reacts with water. Air supply should be dry. Containers should be kept tightly closed. Use urethane grade thinners only.
- Alcohols and glycols interfere with curing chemistry and should be avoided. They can be found in some lacquer thinners and certain synthetic reducers.
- Optimum film properties are dependent upon proper mixing of paint and catalyst.

SAFETY: Refer to the product's Material Safety Data Sheet (MSDS) for complete safety information. Contains organic solvents. Use with adequate ventilation. Do not breathe vapors or spray mists. If component TLVs are exceeded, a NIOSH approved air supplied respirator is advised. See MSDS for TLV information.

Contents are **FLAMMABLE**. Keep from heat, sparks or open flame.

Allergic reactions are possible. Avoid use by persons with respiratory problems.

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling.

FIRST AID:

Eye contact: flush immediately with plenty of water for at least 15 min. and get medical attention.

Skin contact: wash thoroughly with soap and water for 5 minutes.

If swallowed, do not induce vomiting and get medical attention immediately.

PRODUCT IDENTIFICATION

6760-4702 (example)
 6760 Color number
 4702 Gloss: D - 5*
 Special: e.g., 2 = metallic; 6 = primer
 Product type

C14TL

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CARDINAL

product
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6400 / 340HP SERIES
HIGH SOLIDS POLYURETHANE

Cardinal's 6400 series catalyzed with 340HP is a high-solids aliphatic two-component polyurethane coating. This coating is well suited for exterior applications on both metal and plastic. The 6400 Series was formulated to meet strict air quality regulations, while maintaining the application and performance benefits of a conventional polyurethane coating. Cardinal's 6400 series high solids polyurethane coating is available in a full selection of color and gloss, including metallic, cardtex finish and clear.

TYPICAL USES:

- Top coat for decorative and protective use on metal and plastic
- General metal finishing
- Electronic enclosures
- Trailers and vehicles
- Machinery

BENEFITS:

- Low VOC – 2.8 lbs/gal
- Very high gloss
- Excellent chemical and solvent resistance
- UL approved (phosphatized steel electronics enclosures)
- Available in a complete range of colors, glosses, textures and cardtex finishes
- RoHS / WEEE compliant

CURED FILM PROPERTIES:

Testing conducted on 6409-10 gloss white catalyzed with 340HP at 1.5 mils DFT (Dry Film Thickness) over 20 gauge Bonderite 1000® test panels, cured 30 minutes at 180°F and air dried 14 days.

TEST	METHOD	PARAMETERS	RESULT
Adhesion	ASTM D3359	Cross-hatch tape	0% failure
Impact:	ASTM D2794	Direct Reverse	130 in. lbs 60 in. lbs
Flexibility:	ASTM D1737	1/8" mandrel	No cracking
Hardness	ASTM D3363	Pencil	H - 2H
Abrasion	ASTM D4060	CS-17 wheels, 1 kg, 1000 cycles	Less than 100 mg loss
Humidity	ASTM D2247	168 hrs	No effect
Salt Spray	ASTM B117	1000 hrs 95%, 5% salt solution	Less than 3/16" creep - along scribe, otherwise, no effect
UV Light	ASTM G53	1000 hrs	90.3% gloss retention
Solvent Resistance	ASTM D4752	MEK 100 rubs IPA 200 rubs	No effect No effect
Chemical & Stain Resistance	ASTM D1308 30 min. spot	A – 0.1N HCl, 30 wt. motor oil, ammonia, butyl carbitol, butyl cellosolve, Cascade®, Clorox®, Coca Cola®, coffee, diethyl ether, Drano®, Fantastic®, fiber pen ink, floor stripper, gasoline, IPA, Ivory® Liquid, lanolin lotion, lemon juice, Snap®, Spic & Span®, tap water, vegetable oil, water base ink, WD-40®. B – ball point pen ink, carbon disulfide, correction fluid, Freon TF®, MEK, nail polish. C – chloroform. D – solvent base ink.	A: No effect B: Slight dulling C: Moderate effect D: Discolored & softened

FOR INDUSTRIAL USE ONLY
NOT FOR RESIDENTIAL USE

TYPE: Aliphatic polyester polyurethane.

COMPONENTS: Two.

COLORS: Full range including metallics.

GLOSS: High, semi and flat.

COVERAGE: At 1.0 mil DFT, 65% transfer efficiency(TE)

Mixed paint, 2.8 lbs/gal : 620 ft²/gal.

Mixed paint, 3.5 lbs/gal : 520 ft²/gal.

Calculation: 1604 ft²/gal x % volume solids x TE + DFT

VOC MIXED: 340 grams/liter = 2.8 lbs/gal minimum.

420 grams/liter = 3.5 lbs/gal minimum.

See mix ratio table below.

VOLUME SOLIDS:

6400 gloss base 53%

340HP 87%

Mixed to 2.8 lbs/gal 60%

Mixed to 3.5 lbs/gal 49%

FLASH POINT: 24°F TCC

SHELF LIFE: 1 year from date of manufacture in factory sealed container.

APPLICATION: After preparing the surface, thoroughly mix component 1 before adding catalyst. Mix only the amount of material needed. The base to catalyst proportion must be measured accurately, by volume only, to obtain optimum film properties. Do not use reducers that contain water or alcohol; these react with the catalyst and can cause a variety of problems. Be aware of spray-able pot life. Brushing, rolling and dipping are not recommended.

APPLICATION CONDITIONS:

- Temperature – Apply coating within 55-100 F.
- Relative Humidity – Not recommended to apply in conditions greater than 85%.
- Substrate temperature – 5° above the dew point and a minimum of 55°F.

If coating is not applied within these conditions then the cured coating properties may not be representative.

MIX RATIOS: Two components must be mixed properly to obtain coating performance. Thinning depends on applicator's regulatory VOC limits.

Parts are by volume	COLORS GLOSS	COLORS SEMI GLOSS	CLEAR ALL GLOSS
6400 base	4	5	4
340HP catalyst	1	1	1
1600-0# reducer for 340 gms/l	0	1/2	N/A
for 420 gms/l	1	1-1/2	1

VISCOSITY: Will vary depending on color and gloss at a given VOC. At 2.8 lbs/gal, most semi gloss colors will be in the 25"-30" #3 Zahn range. At 3.5 lbs/gal, 28"-32" #2 Zahn can be expected for most colors.

SPRAY-able Pot Life: 2-3 hrs. at 2.8 lbs. VOC/gal

4-5 hrs. at 3.5 lbs. VOC/gal

Note: If material is accelerated the actual pot life may vary depending on amount added.

RECOMMENDED DFT: 1.5 – 2.5 mils (depending on color)

CURE:

Air Dry

Force Dry *

Tack free 2 hrs.

1 hr at 120° F

Dry to handle 24 hrs.

30 min at 140° F

Dry hard 72 hrs.

15 min at 180° F

(At 1.5 mils dry film thickness, 78° F, 50% RH)

(Continued on page 2)

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6400 / 340HP SERIES

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SURFACE PREPARATION AND PRIMING: The most important steps in a successful coating process are cleaning, pretreatment and priming. The following is a brief outline of some basics for unpainted substrates. It is not intended to be all-inclusive. For more information on your particular application contact Cardinal.

Cleaning the substrate: All surfaces to be coated, must be free of dirt, grease, oil, oxidation, mill scale, and all other contaminants. The surface must be thoroughly dry before painting. Air quality regulations have limited the allowable emissions from cleaning operations.

Steel — A phosphate chemical conversion coating is highly recommended. When this is not possible, a vinyl acid wash pretreatment primer is recommended such as Cardinal's 4860 series primers. UL approval on our product requires the minimum of a three stage iron phosphate pre-treatment.

Aluminum — A chemical conversion coating is highly recommended. When this is not possible, a vinyl acid wash pretreatment primer is recommended such as Cardinal's 4860 series primers.

Galvanized — Cardinal's W-303-A surface preparation solution helps improve adhesion followed by a vinyl acid wash pretreatment primer such as Cardinal's 4860 series primers.

Stainless Steel — Brush-off or blast clean per SSPC-SP 7 to a uniform profile of 1.5 mils. Cardinal's W-303-A surface preparation solution can help improve adhesion followed by a vinyl acid wash pretreatment primer such as Cardinal's 4860 series primers.

Plastic — All mold release should be completely removed. 6400 series polyurethane is compatible with a variety of plastics, however, since there are numerous different formulations of plastic, a trial sample should be painted and checked before running production. If 6400 attacks or weakens the plastic, a barrier coat of 3777-1 clear waterborne acrylic enamel may help.

PRIMER SELECTION:

PRODUCT NO.	DESCRIPTION	FUNCTION
6460-4702	Polyurethane Gray	Corrosion resistance, some surfacing
7760-4702	Epoxy Gray	Corrosion resistance, chemical resistance
7063-4702	Epoxy Gray	Corrosion resistance, chemical resistance and high build
3777-1	Waterborne Acrylic Clear	Barrier coat for some plastics

RELATED PRODUCTS:

PRODUCT NO.	DESCRIPTION
1600 Series Reducers	Thinners. Urethane grade. 1600-01, fast; 1600-02, medium; 1600-03, slow.
EL-005	Accelerator. Speeds up dry time (and shortens pot life).
J-3081	Surfactant. Helps eliminate blisters, bubbles, pin holes, solvent-pop.
P-5033	Surfactant. Helps eliminate craters and fish-eyes.

TROUBLE SHOOTING:

PROBLEM	CAUSE	REMEDY
Blisters, pin holes or solvent pop	Water contamination. Entrapped air. Entrapped solvent	Eliminate water — Check air lines. Use fresh catalyst. Use urethane grade thinners. Increase atomization, decrease film build.
Craters	Contaminated ambient air, e.g., silicone mist, dust.	Locate and eliminate source of contamination.
Fish-eyes	Substrate contamination.	Clean and prepare substrate.
Not drying	Alcohol in reducer. Wrong catalyst ratio.	Use Cardinal's 1600 series or urethane grade reducers only. Double check mix ratio.
Poor adhesion	Improper surface preparation.	See surface preparation section.
Gloss variation	Variation in application, cure schedule, catalyst ratio, humidity.	Consistent gloss depends upon consistent process.

PRODUCT IDENTIFICATION

6409-16473 (example)

Color number
Gloss: 0 = flat; 1 = 10°; 2 = 20° ... etc.; 70° - 90°+ = high gloss
Special: e.g., 2 = metallic; 3 = cardtex; 4 = texture; 6 = primer; 7 = clear
Product type

* Some Air quality regulations require a maximum temp. of 194° F to qualify as an "air dry" system which generally have higher VOC limits than baking systems.

APPLICATION EQUIPMENT: Most air quality regulations require the paint application transfer efficiency to be 65% or better. This generally means using electrostatic or high volume low pressure (HVLP) spray guns. Otherwise, conventional pressure feed, airless or air assisted airless spray equipment can be used. Air supply lines need water and oil traps.

EQUIPMENT CLEAN-UP: Clean up should be done as soon as possible keeping in mind the pot life of the mixed paint. Avoid leaving catalyzed paint in the lines. Air quality regulations have limited the allowable emissions from cleaning operations.

PRODUCT LIMITATIONS:

- Catalyst reacts with water. Air supply should be dry. Containers should be kept tightly closed. Use urethane grade thinners only.
- Alcohols and glycols interfere with curing chemistry and should be avoided. They can be found in some lacquer thinners and certain synthetic reducers.
- Optimum film properties are dependent upon proper mixing of paint and catalyst.

SAFETY: Refer to the product's Material Safety Data Sheet (MSDS) for complete safety information.

Contains organic solvents. Use with adequate ventilation. Do not breathe vapors or spray mists. If component TLVs are exceeded, a NIOSH approved air supplied respirator is advised. See MSDS for TLV information.

Contents are FLAMMABLE. Keep from heat, sparks or open flame.

Allergic reactions are possible. Avoid use by persons with respiratory problems.

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling.

FIRST AID:

Eye contact: flush immediately with plenty of water for at least 15 min. and get medical attention.

Skin contact: wash thoroughly with soap and water for 5 minutes.

If swallowed, do not induce vomiting and get medical attention immediately.

G12TL

IMPORTANT: Warranty and Disclaimer — The performance characteristics of these products vary according to product application, operating conditions, materials applied to or with and use. Since these factors can affect results, we strongly recommend that you make your own test to determine to your satisfaction whether the product is of acceptable quality, has not been affected by storage or transport and is suitable for your particular purpose under your own operation conditions prior to using any product in full scale production. Seller warrants the products to be free from defects in materials and workmanship. SUCH WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE. No representative of ours has authority to waive or change this provision, which applies to all sales of these products.

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TECHNICAL DATA

PR-148 Adhesion Promoter

Description

PR-148 is an adhesion promoter to enhance the coupling characteristics of polysulfide compounds to a wide variety of substrates. PR-148 is a one-part compound suitable for application by brush or clean gauze.

This product is fully qualified to the AMS 3100 Class 1 specification and PRC-DeSoto International specification test methods.

Application Properties (Typical)

Color	Blue
Appearance	Free of particles
Dry time, 30%-70% RH	
77°F (25°C)	15 minutes
60°F (16°C)	45 minutes
40°F (4°C)	45 minutes

Performance Properties (Typical)

Specific gravity	0.81
Flash point, PMCC	23°F (-5°C)
Effects on finishes	Does not soften finishes
Peel strength*, pli (N/25 mm), 100% cohesion	
JRF/3% NaCl immersion, 7 days @ 140°F (60°C)	
MIL-C-27725 (IFT coating)	56 (250)
Aged MIL-C-27725 (IFT coating)	55 (245)
AMS 4911 (Titanium)	57 (254)
NaCl-H ₂ O immersion, 7 days @ 140°F (60°C)	
MIL-P-23377 (Epoxy Primer)	73 (325)
MIL-P-85582	
(Water Based Primer)	75 (334)
MIL-S-5059 (Stainless steel)	27 (120)
MIL-T-9046 (Titanium comp. C)	28 (125)
Dry	
MIL-P-5425 (Acrylic)**	67 (298)

* Tested with PR-1440 B-2 (AMS-S-8802) sealant

**PR-148 is not recommended for use on substrates where solvent crazing would be of concern. Please examine using our PR-142 adhesion promoter instead.

Note: The application and performance property values above are typical for the material, but not intended for use in specifications or for acceptance inspection criteria because of variations in testing methods, conditions and configurations.

Surface Preparation

Immediately before applying adhesion promoter to primed substrates, the surfaces should be cleaned with solvents. Contaminants such as dirt, grease, and/or processing lubricants must be removed prior to sealant application.

A progressive cleaning procedure should be employed using appropriate solvents and a new lint-free cloth conforming to AMS 3819. (Reclaimed solvents or tissue paper should not be used.) Always pour solvent on the cloth to avoid contaminating the solvent supply. Wash one small area at a time.

It is important that the surface is dried with a second clean cloth prior to the solvent evaporating to prevent the redeposition of contaminants on the substrate.

Application Instructions

Apply a thin coat of PR-148 to the solvent-cleaned surface by brush or clean gauze pad and allow to dry for the required dry time. After dry time, wipe off excess PR-148 with a clean gauze pad and start the sealing procedure. If primed surface becomes contaminated or sealing is not accomplished within 8 hours after application of the adhesion promoter, repeat priming procedure.

For a more thorough discussion of proper surface preparation, please consult the SAE Aerospace Information Report AIR 4069. This document is available through SAE, 400 Commonwealth Avenue, Warrendale, PA 15096-0001.

Packing Options

PR-148 Adhesion promoter is supplied in one-part containers.

Storage Life

The storage life of PR-148 is at least 6 months when stored at temperatures below 80°F (27°C) in original, unopened containers. The material is hygroscopic and must be kept free of moisture. It should be discarded if it becomes cloudy or a precipitate is formed.

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PR-148 Adhesion Promoter

Health Precautions

This product is safe to use and apply when recommended precautions are followed. Before using this product, read and understand the Material Safety Data Sheet (MSDS), which provides information on health, physical and environmental hazards, handling precautions and first aid recommendations. An MSDS is available on request. Avoid overexposure. Obtain medical care in case of extreme overexposure.

For industrial use only. Keep away from children.

Additional information can be found at:
www.ppgaerospace.com

For sales and ordering information call
1-800-AEROMIX (237-6649).

All recommendations, statements, and technical data contained herein are based on tests we believe to be reliable and correct, but accuracy and completeness of said tests are not guaranteed and are not to be construed as a warranty, either expressed or implied. User shall rely on his own information and tests to determine suitability of the product for the intended use and assumes all risks and liability resulting from his use of the product. Seller's and manufacturer's sole responsibility shall be to replace that portion of the product of this manufacturer which proves to be defective. Neither seller nor manufacturer shall be liable to the buyer or any third person for any injury, loss, or damage directly or indirectly resulting from use of, or inability to use, the product. Recommendations or statements other than those contained in a written agreement signed by an officer of the manufacturer shall not be binding upon the manufacturer or seller.

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CARDINAL

product
information

4860-52 AND 4860-4702 ACID ETCHING PRETREATMENT PRIMERS

Cardinal's 4860-52 and 4860-4702 are two component, solvent borne, acid etch wash primers designed for adhesion and corrosion protection. Besides excellent corrosion protection the 4860-52 and 4860-4702 are compliant to spray at 420 g/l and easy to apply. This product is not recommended for use on previously painted parts or plastics.

Part Number / Color: 4860-52 Green 4860-4702 Gray

TYPICAL USES:

- General metal enclosures
- Utility trailers
- Auto After-market

BENEFITS:

- Designed to promote adhesion when chemical conversion coatings are not practical.
- RoHS / WEEE Compliant

CURED FILM PROPERTIES:

Testing conducted on 4860-52 then top coated with 6409-10 gloss white catalyzed with 340HP at 1.5 mils DFT (Dry Film Thickness) over 20 gauge sanded aluminum test panels, cured 30 minutes at 180°F and air dried 14 days.

TEST	METHOD	PARAMETERS	RESULT
Salt Spray	ASTM B117	1500 hrs on sanded Aluminum	No effect
Humidity	ASTM D2247	2000 hrs	No effect

SURFACE PREPARATION AND PRIMING: The most important steps in a successful coating process are cleaning, pretreatment and priming. The following is a brief outline of some basics for unpainted substrates. It is not intended to be all-inclusive. For more information on your particular application contact Cardinal.

Cleaning the substrate: All surfaces to be coated, must be free of dirt, grease, oil, oxidation, mill scale, and all other contaminants. The surface must be thoroughly dry before painting. Air quality regulations have limited the allowable emissions from cleaning operations.

Aluminum — Cardinal's 4860-52 (4702) pretreatment primers are to be used when a Aluminum chemical conversion coating is not possible.

Galvanized — Cardinal's W-303-A surface preparation solution helps improve adhesion followed by a vinyl acid wash pretreatment primer such as Cardinal's 4860-52 (4702) primer.

Magnesium Alloy — Cardinal's 4860-52 (4702) pretreatment primers are to be used when a Aluminum chemical conversion coating is not possible.

Stainless Steel — White metal blast cleaning per SSPC-SP 7 / NACE No.1 to a uniform profile of 1.5 mils. Cardinal's W-303-A surface preparation solution can help improve adhesion followed by a vinyl acid etching pretreatment primer such as 4860-52 (4702).

FOR INDUSTRIAL USE ONLY
NOT FOR RESIDENTIAL USE

TYPE: Acid etching pretreatment primer.

COMPONENTS: Two.

COLORS: Green and Gray.

GLOSS: D-5° Flat @ 60° L

COVERAGE: At 0.5 – 1.0 mil DFT (Dry Film Thickness)

65% transfer efficiency (TE)

Mixed paint, 3.5 lbs/gal : 112 ft²/gal.

Calculation: 1604 ft²/gal x % volume solids x TE = DFT

VOC MIXED:

	Coating VOC less exempt	Coating VOC including exempt
4860 Primer	<295 g/l (2.5 lbs/gal)	<81 g/l (0.68 lbs/gal)
1000-52 Activator	755 g/l (6.29 lbs/gal)	37 g/l (0.31 lbs/gal)
Mixed 1 part 4860	<420 g/l (3.5 lbs/gal)	51 g/l (0.43 lbs/gal)
2 parts 1000-52	0.5% Acid by Weight Minimum	<12% Non-Volatile Weight

VOLUME SOLIDS: 17 – 18% 6 – 7% mixed

FLASH POINT: -4°F method / TCC

SHELF LIFE: 1 year from date of manufacture in factory sealed container at 50° to 100° F.

APPLICATION: All types of conventional spray equipment or HVLP may be used. A dry film of 0.5 – 1.0 mil must be applied; at this film thickness a transparent coating will be produced. Heavier film thickness will be detrimental to the complete coating system.

MIXING: Two components must be mixed properly to obtain coating performance.

COMPONENT	PARTS BY VOLUME
4860 PRIMER	1
1000-52	2

VISCOSITY: Mixed - 16" - 18" #2 Zahn

SPRAY-able Pot Life: 8 hours after mixing.

RECOMMENDED DFT: 0.5 – 1.0 mil dry film thickness

CURE: Air Dry @ 70°F + 50% RH @ 3 mil

Set to Touch 15 min.

Dry Hard 30 – 60 min.

Time to Topcoat 1 hr.* or 3 hrs.**

* for solventborne topcoats ** for waterborne topcoats

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4860-52, 4860-4702

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RELATED PRODUCTS:

PRODUCT NO.	DESCRIPTION
1000-13	Fast Exempt Reducer
HP-439	Medium Exempt Reducer

TROUBLE SHOOTING:

PROBLEM	CAUSE	REMEDY
Blisters, pin holes or solvent pop	Water contamination. Entrapped air. Entrapped solvent	Eliminate water – Check air lines. Use fresh catalyst. Use urethane grade thinners. Increase atomization, decrease film build.
Craters	Contaminated ambient air, e.g., silicone mist, dust.	Locate and eliminate source of contamination.
Fish-eyes	Substrate contamination.	Clean and prepare substrate.
Poor adhesion	Improper surface preparation.	See surface preparation section.

APPLICATION EQUIPMENT: Most air quality regulations require the paint application transfer efficiency to be 65% or better. This can be accomplished by using HVLP spray guns; otherwise, conventional pressure feed, airless or air assisted airless spray equipment can be used. Air supply lines need water and oil traps.

EQUIPMENT CLEAN-UP: Clean up should be done as soon as possible keeping in mind the pot life of the mixed paint. Air quality regulations have limited the allowable emissions from cleaning operations. Strong solvents such as acetone provide adequate cleaning.

PRODUCT LIMITATIONS:

- This product is designed for adhesion promotion only
- De-lamination may occur at a higher film thickness
- Do not store mixed material in contact with metal containers

SAFETY: Refer to the product's Material Safety Data Sheet (MSDS) for complete safety information. Contains organic solvents. Use with adequate ventilation. Do not breathe vapors or spray mists. If component TLVs are exceeded, a NIOSH approved air supplied respirator is advised. See MSDS for TLV information.

Contents are **FLAMMABLE**. Keep from heat, sparks or open flame.

Allergic reactions are possible. Avoid use by persons with respiratory problems.

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling.

FIRST AID:

Eye contact: flush immediately with plenty of water for at least 15 min. and get medical attention.

Skin contact: wash thoroughly with soap and water for 5 minutes.

If swallowed, do not induce vomiting and get medical attention immediately.

PRODUCT IDENTIFICATION

4860-52 (example)
 ——— Color number
 ——— Gloss: 0 - 5°
 ——— Special: e.g., 6 = primer
 ——— Product type

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M A T E R I A L S A F E T Y D A T A S H E E T

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CARDINAL INDUSTRIAL FINISHES

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340 HP H/S POLY CATALYST

SECTION I COMPANY AND PRODUCT INFORMATION

CARDINAL INDUSTRIAL FINISHES

1329 POTRERO AVENUE

SOUTH EL MONTE, CA 91733

INFORMATION:

24-Hour Emergency Phone:

PREPARED BY:

PHONE: (626) 444-9274 or (323) 283-9335 FAX: (626) 444-0382

(800) 424-9300 Chemtrec

Richard A. Stewart

PRODUCT:

GENERAL DESCRIPTION:

340 HP H/S POLY CATALYST

CATALYST

HMIS CODES:

H: 2* P: 3 R: 1 P:

SECTION II HAZARDOUS INGREDIENTS

INGREDIENT	EXPOSURE LIMITS	V. P. (mmHg @ 20°C)	CAS No.	% WT
n-Butyl Acetate	OSHA PEL: 150 PPM; ACGIH TLV: 150 PPM	10	123-86-4	5% - 10%

n/a

SECTION III PHYSICAL DATA

BOILING RANGE: 260 deg F

VAPOR DENSITY: Heavier than air

EVAPORATION RATE: Slower Than Ether

% VOLATILE BY VOLUME: 12.51%

% SOLIDS BY VOLUME: 87.491

% EXEMPT BY VOLUME: 0

VOC CONTENT:

EXCLUDING EXEMPT: 0.9205 lb/gal

INCLUDING EXEMPT: 0.9205 lb/gal

CATALYST

SPECIFIC GRAVITY: 1.1296

WEIGHT PER GALLON: 9.4058 lb/gal

% VOLATILE BY WEIGHT: 9.79%

% SOLIDS BY WEIGHT: 90.214

% EXEMPT BY WEIGHT: 0

110 g/l

110 g/l

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340 HP H/S POLY CATALYST

SECTION IV FIRE AND EXPLOSION RISKS

FLASH POINT: 79 deg F METHOD: TCC L.E.L.: 1.7 U.E.L.: 7.6
EXTINGUISHING MEDIA: Foam, alcohol foam, CO2, dry chemical, water fog.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Containers may deform or explode when exposed to extreme heat.
Decomposition products may yield oxides of carbon and nitrogen.

SPECIAL FIREFIGHTING PROCEDURES: Self-contained breathing apparatus with full facepiece operated
in pressure demand or other positive pressure modes.

SECTION V HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

SKIN CONTACT: Moderate irritation possible from prolonged exposure; defatting and dermatitis.
EYE CONTACT: Can cause irritation and redness, tearing and blurred vision.
INHALATION: May cause nasal irritation, headache, dizziness, nausea, weakness or vomiting. Loss of consciousness.
INGESTION: Can cause gastrointestinal irritation, headache, dizziness, nausea and weakness.
ACUTE: Can cause moderate skin irritation, defatting, dermatitis and tingling sensation. Can cause serious eye
irritation, redness, tearing and blurred vision.
CHRONIC: May produce liver and kidney damage, persistent coughing, brain damage and may be fatal.

CARCINOGENICITY: This product contains: NONE

(No carcinogenic chemicals are present)

MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: Pre-existing respiratory conditions, Pre-existing skin
disorders, liver and kidney disorders. Allergic reactions possible.

PRIMARY ENTRY ROUTES OF EXPOSURE: Dermal and Inhalation

EMERGENCY AND FIRST AID PROCEDURES:

EYE CONTACT: Flush with large quantities of water for 15 to 30 minutes. Get medical attention.
SKIN CONTACT: Wash exposed area with mild soap and water for 15 minutes. Remove contaminated clothing.
INHALATION: Remove victim to fresh air. If breathing is difficult, administer oxygen. If breathing has
stopped, give artificial respiration. Get immediate medical attention.
INGESTION: < DO NOT INDUCE VOMITING > Keep victim warm and seek immediate medical attention.

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CARDINAL INDUSTRIAL FINISHES

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340 HP H/S POLY CATALYST

SECTION VI REACTIVITY DATA

STABILITY: Stable.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Extremely high temperatures.

INCOMPATIBILITY (MATERIALS TO AVOID): Water, amines, strong bases, alcohol's, metal compounds and surface active materials.

HAZARDOUS DECOMPOSITION OR BY PRODUCTS: Hazardous decomposition may produce carbon dioxide and/or carbon monoxide.

SECTION VII SPILL AND LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Refer to other sections in this document. Eliminate all sources of ignition. Absorb liquid in absorbent material (i.e. dry sand or earth), then place in a chemical waste container for proper disposal. Prevent spreading to ground water. Avoid runoff into storm sewers and ditches that lead to waterways.

WASTE DISPOSAL METHOD: Recycle whenever possible or destroy by liquid incineration in accordance with applicable regulations. Contaminated absorbent should be incinerated or sent to an approved landfill in accordance with Local, State, and Federal Regulations.

SECTION VIII SAFE HANDLING AND USE INFORMATION

RESPIRATORY PROTECTION: If TLV of the product or any component is exceeded, a NIOSH approved Air Supplied Respirator is advised in absence of environmental control. OSHA Regulations also permit other NIOSH Respirators under specified conditions. (See your Safety Equipment Supplier) Engineering or administrative controls should be implemented to reduce exposure. When coating is catalyzed, low levels of isocyanates are present. See MSDS sheet for catalyst specific information on compounds present in catalyst. In lieu of air monitoring, air supplied respirators are suggested for spray application.

VENTILATION: Provide sufficient mechanical (General and/or local exhaust) Ventilation to maintain exposure below the TLV's.

PROTECTIVE GLOVES: Wear resistant gloves such as: polyvinyl alcohol coated or polyethylene.

EYE PROTECTION: Wear OSHA approved chemical splash goggles. (Consult your safety equipment supplier)

OTHER PROTECTIVE EQUIPMENT: Prevent repeated or prolonged skin contact with GB Protective Handcream, wear impervious clothing and chemical resistant boots.

HYGIENIC PRACTICES: Wash hands before eating or using the rest room, smoke in smoking areas only.

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M A T E R I A L S A F E T Y D A T A S H E E T

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CARDINAL INDUSTRIAL FINISHES

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340 HP H/S POLY CATALYST

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Containers may be hazardous when emptied, since emptied containers may retain product residuals (Vapors, Liquid, and/or Solids). All precautions given in this data sheet must be observed. Store at room temperature away from heat sources, and have lids tightly closed.

OTHER PRECAUTIONS: Paint and solvents have been linked liver abnormalities, kidney and lung damage. For Industrial Use Only with adequate ventilation. Follow precautions of this Material Safety Data Sheet to prevent exposure.

SECTION X SHIPPING INFORMATION

D.O.T. SHIPPING NAME : Paint Related Material
D.O.T. HAZARD CLASS : 3
UN/NA NUMBER : UN1263
PACKAGING GROUP : PG II
D.O.T. LABELS REQUIRED : Flammable

SECTION XI OTHER REGULATORY INFORMATION

Toxic Control Act: All components of this product are listed on the EPA TSCA Inventory or exempt from notification.

Canadian Environmental Protection: All of the components of this product are approved and listed on the Canadian Domestic Substance List or exempt from notification requirements.

California Proposition 65:
This product contains no chemicals reportable under Proposition 65.

n/a

The information contained in this Material Safety Data Sheet is considered to be true and accurate. Cardinal Industrial Finishes makes no warranties, expressed or implied, as to the accuracy and adequacy of this information. This data is offered solely for the user's consideration, investigation and verification.

SUBJECT:
WORK INSTRUCTION
PAINT COATINGS

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Designation: B912 – 02 (Reapproved 2013)

Standard Specification for Passivation of Stainless Steels Using Electropolishing¹

This standard is issued under the fixed designation B912; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the passivation of stainless steel alloys in the 200 (UNS2XXXX), 300 (UNS3XXXX), and 400 (UNS4XXXX) series, and the precipitation-hardened alloys, using electropolishing procedures.

Note 1—Surface passivation occurs simultaneously with electropolishing under proper operating conditions. The quality of passivation will depend on the type of stainless steel, the formulation of the electropolishing solution, and the conditions of operation. Free iron on the surface of the stainless steel is removed resulting in improved corrosion resistance. Surface smoothing obtained by electropolishing will also improve corrosion resistance. Electropolishing will also remove heat tint and oxide scale.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This specification may involve hazardous materials, operations, and equipment. This specification does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- A380 Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
- A967 Specification for Chemical Passivation Treatments for Stainless Steel Parts
- B117 Practice for Operating Salt Spray (Fog) Apparatus
- B322 Guide for Cleaning Metals Prior to Electroplating
- B374 Terminology Relating to Electroplating
- B602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings

D3951 Practice for Commercial Packaging

2.2 ISO Standards:³

- ISO 2080 Electroplating and Related Processes—Vocabulary
- ISO 4519 Electrodeposited Metallic Coatings and Related Finishes—Sampling Procedures for Inspection by Attributes
- ISO 9227 Corrosion Tests in Artificial Atmospheres—Salt Spray Tests
- ISO 15730 Metallic and Other Inorganic Coatings—Electropolishing as a Means of Smoothing and Passivating Stainless Steels

3. Terminology

3.1 Definitions:

3.1.1 *electropolishing, n*—electrochemical process in which the article(s) to be passivated are treated anodically in a suitable acid medium.

3.1.2 *passivation, n*—rendering of a stainless steel surface into a lower state of chemical reactivity.

3.1.2.1 *Discussion*—Passivated surfaces are characterized by the absence of free iron, as defined by Practice A380.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 Definitions of terms in this specification can be found in Terminology B374 and ISO 2080.

4. Ordering Information

4.1 When ordering articles to be electropolished in conformance with this standard, the purchaser shall state the following:

4.1.1 *Alloy Designation*—When ordering articles passivated in accordance with this specification, the purchaser shall state, in addition to the ASTM designation number, the date of issue, the alloy designation number, and the testing method(s) by which the article will be evaluated (see 5.3).

4.1.2 *Appearance*—The purchaser shall specify the appearance required, for example, bright or dull. Unless otherwise specified by the purchaser, a bright luster shall be acceptable. Alternatively, samples showing the required finish, or range of finish, shall be supplied or approved by the purchaser. When

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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required, the basis material may be subjected, before electropolishing, to such mechanical polishing as may be required to yield the desired final surface characteristics.

4.1.3 Contact Marks—Visible contact marks may occur. The location of electrical contact marks shall be agreed upon between purchaser and supplier.

4.1.4 Metal Removal—Some metal is removed from the surface of the article during electropolishing, typically 5 to 10 μm . As much as 50 μm may be removed for additional smoothing. The ordering document shall include the maximum amount of metal to be removed.

4.1.5 Any requirement for certification—See Section 9.

4.1.6 Any requirement for packaging—See Section 10.

5. Product Requirements

5.1 Visual Defects—When specified, the significant surfaces of the article to be passivated by electropolishing shall be free of clearly visible defects such as pits, roughness, striations, or discoloration when examined with 20/20 eyesight at a distance of approximately 0.5 m.

Note: 2—Defects in the surface of the basis material such as scratches, porosity, inclusions, and so forth, may adversely affect the appearance and performance of the article. Visible examination shall include wearing correctional glasses if the inspector normally wears them.

5.2 Process:

5.2.1 Surface Preparation—Preparatory procedures and cleaning of the basis material may be necessary; see Practices A380 and B322.

5.2.2 Electropolishing—Following the preparatory operations, the articles are introduced into the electropolishing solution for a period of time at the current density and temperature required to produce the passive surface and required surface finish, if any.

Note: 3—A typical electropolishing solution and operating conditions suitable for many stainless steel alloys is shown in Appendix X1. Proprietary electropolishing solutions are available offering special features such as low sludging, better bright throwing power, longer life, or better performance with specific stainless steel alloys.

Note: 4—Intricately shaped articles may not receive the same degree of passivation in recessed area as a result of low-current densities. Increasing time or overall current density, or both, or the use of auxiliary cathodes, may be used to improve electropolishing in these areas and to pass subsequent passivation tests.

5.2.3 Post Dip—Articles withdrawn from the electropolishing solution will have a residual film that may adversely affect the appearance or performance of the product. The preferred method of removing this film is by rinsing the articles in a room-temperature solution of 10 to 30 % v/v nitric acid (specific gravity 1.42, 70 % w/w).

5.2.3.1 Where local conditions prevent the use of nitric acid (nitrates) for film removal, other options may be used as long as the articles meet the requirements of 5.3.

Note: 5—A 60-g/L solution of citric acid has been used for film removal; however, note that this procedure may pose waste treatment difficulties. The use of other mineral acids, such as sulfuric or hydrochloric acids, is not recommended as the passive film may be compromised. Neutralization procedures such as immersion in alkaline solutions should not be used as they can have a tendency to "set" the residual film and detract from appearance and performance.

5.2.4 Final Rinsing—Rinsing subsequent to passivation is necessary to remove all traces of acidified water that may affect the appearance and performance of the passive part. Deionized or distilled water may be used to avoid water spots.

5.3 Passivation Testing:

5.3.1 Passivation by electropolishing shall be evaluated by one or more of the following test methods (see Section 6 for test procedures):

5.3.1.1 Water immersion test.

5.3.1.2 Humidity test.

5.3.1.3 Salt spray test.

5.3.1.4 Copper sulfate test, and

5.3.1.5 Modified "Ferroxyl" test for free iron.

6. Test Procedures

6.1 Water Immersion Test (Specification A967)—The article(s) shall be alternately immersed in distilled water for 1 h, then allowed to dry for 1 h for twelve wet-dry cycles (24 h total). Failure is indicated by the presence of red rust or staining as a result of the presence of free iron on the surface.

6.2 Humidity Test (Practice A380, Specification A967)—The article(s) shall be subjected to 100 % humidity at $38 \pm 2^\circ\text{C}$ in a suitable humidity cabinet for a period of 24 h. Failure is indicated by the presence of red rust or staining as a result of the presence of free iron on the surface.

6.3 Salt Spray (Fog) Testing (Practice B117 (ISO 9227))—The article(s) shall be subjected to the prescribed test for a minimum of 2 h in an accredited cabinet. Failure is indicated by the presence of red rust or staining as a result of the presence of free iron on the surface.

6.4 Copper Sulfate Test (Practice A380, Specification A967)—See Appendix X2. The article is swabbed with an acidified solution of copper sulfate. Failure is indicated by the presence of a copper-colored deposit or copper-colored spots, or both. This test is not to be used on martensitic 400 series stainless steels.

6.5 Modified "Ferroxyl" Test (Practice A380, Specification A967)—See Appendix X3. The article is swabbed with a solution of potassium ferricyanide. Failure is indicated by the presence of a dark blue color within 30 s.

7. Sampling Requirements

7.1 Test Method B602 (ISO 4519) can be applied to finishes such as electropolished surfaces.

7.2 A random sample of the size required by Test Method B602 shall be selected from the inspection lot (see 7.3). The articles in the lot shall be inspected for conformance to the requirements of this specification and the lot shall be classified as conforming or not conforming to each requirement according to the criteria of the sampling plans in Test Method B602.

Note: 6—Test Method B602 contains four sampling plans for the original inspection of coated articles. Three are to be used when the test methods are nondestructive; that is, the test method does not make the articles nonconforming. The fourth plan is used when the test method is destructive. If it is not clear whether the test is destructive or nondestructive, the purchaser should identify which test methods are

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destructive and which are nondestructive. In some instances, both destructive and nondestructive test methods may exist for the testing of the conformance of a finish to a particular requirement. The purchaser should state which is to be used.

7.3 An inspection lot shall be defined as a collection of articles that are of the same kind, that have been produced to the same specifications, that have been finished by a single supplier at one time, or at approximately the same time, under essentially identical conditions, and that are submitted for acceptance or rejection as a group.

7.4 If separate test specimens are used to represent the articles in a test, the specimens shall be of the nature, size, and number, and be processed as required in the test methods of this specification. Unless a need can be demonstrated, separately prepared specimens shall not be used in place of production articles for nondestructive tests and visual examination. For destructive tests, separately prepared specimens may be used.

8. Rejection and Rehearing

8.1 Parts that fail to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with test results, the producer or supplier may make a claim for a rehearing.

9. Certification

9.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

10. Packaging

10.1 If packaging requirements are necessary under this specification, they shall be in accordance with Practice D3951.

11. Test Report

11.1 The test report shall include the following information:

- 11.1.1 A reference to this standard.
- 11.1.2 A reference to the test method(s) used (see 5.3.1).
- 11.1.3 The location(s) of the test area(s) on each specimen.
- 11.1.4 The quantity of specimens tested.
- 11.1.5 The name of the operator and the testing laboratory.
- 11.1.6 The date on which the test(s) was (were) performed.
- 11.1.7 Any circumstances or conditions thought likely to affect the results or their validity.
- 11.1.8 Any deviation from the test method specified, and
- 11.1.9 The result(s) of the test(s) (see Section 6).

12. Keywords

12.1 electropolishing; passivation; stainless steel

APPENDICES

(Nonmandatory Information)

X1. TYPICAL ELECTROPOLISHING SOLUTION

X1.1 Electropolishing Materials:

Sulfuric acid, 96 %w/w	50 %v/v
Orthophosphoric acid, 85 %w/w	50 %v/v
Current density	15 amp/dm ² minimum
Temperature	75°C
Time, typical	2 to 4 min
Cathodes	stainless steel, copper, lead

X2. COPPER SULFATE TEST (FOR FREE IRON)

X2.1 Materials—Copper sulfate test solution:

Distilled water	100 mL
Sulfuric acid, 96 %w/w	0.4 mL
Copper sulfate, ACS, (CuSO ₄ · 5H ₂ O)	1.6 g

(dissolve all ingredients)

X2.2 Procedure—Using a cotton swab, apply the test solution to a clean area of the passivated surface to be tested,

keeping the surface wet for a period of 6 min. The formation of a copper-colored deposit or copper-colored spots or both indicates failure. Parts used for testing should be discarded or reprocessed.

X2.3 Storage—The test solution shall be made up fresh every two weeks.

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X3. MODIFIED “FERROXYL” TEST (FOR FREE IRON)

X3.1 Materials—Potassium ferricyanide test solution:

Distilled water	70 mL
Potassium ferricyanide, ACS ($K_3Fe(CN)_6$)	1.0 g
Nitric acid, Reagent Grade 70 ± 1 %/w, sp. gr. 1.415 to 1.420	30 mL
(dissolve all ingredients)	

X3.2 Procedure—Using a cotton swab, apply the test solution to a clean area of the passivated surface to be tested. Parts used for testing should be discarded or reprocessed.

X3.3 Storage—The test solution should be made fresh daily.

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